advanced classes, but though his pupils were not numerous, they were picked men, and the list of those who were trained under him includes not a few of the leading geologists of the country today.

The story is chiefly told by his letters to his favorite brother, William Dwight Whitney—letters which reveal the man without the reserve which usually accompanied hm, and which portray in a very graphic and vivid style much of the history of early geological exploration in this country.

R. T. C.

Iowa Geological Survey, Vol. XIX, Annual Report, 1908. With Accompanying Papers. Des Moines, 1909. Pp. 806, 22 plates, 117 figures.

Coal is the principal topic of this volume. Besides the *Seventeenth Annual Report of the State Geologist*, Professor Samuel Calvin, it contains the following papers: "Mineral Production in Iowa in 1908," by S. W. Beyer, pp. 1–20; "Coal Deposits of Iowa," by Henry Hinds, pp. 21–396; "Fuel Values of Iowa Coals," by F. A. Wilder, with analyses of Iowa coals by James H. Lees and A. W. Hixcon, pp. 397–519; "History of Coal Mining in Iowa," by James H. Lees, pp. 521–88; "Coal Statistics," by S. W. Beyer, pp. 591–97; "General Section of the Des Moines Stage of Iowa," by James H. Lees, pp. 598–604; "The Carboniferous Section of Southwestern Iowa," by George L. Smith, pp. 605–57; "Bibliography of Iowa Coals," compiled by James H. Lees, pp. 659–87; "Peat Deposits in Iowa," by S. W. Beyer, pp. 689–730; "Bibliography of Iowa Peat," compiled by James H. Lees, pp. 731–33; "Flora of Northern Iowa Peat Bogs," by L. H. Pammel, pp. 735–77.

R. T. C.

Radioactivity and Geology. An Account of the Influence of Radioactive Energy on Terrestrial History. By J. Joly. Pp. 287, pls. 6, figs. 4. New York: Van Nostrand Co., 1909.

The discovery of radioactivity has opened the way for quite a new conception of many geologic phenomena. Fresh light has been thrown upon obscure and difficult problems, old explanations have been weakened or displaced, and alternative hypotheses have been framed to explain various phenomena. Radioactivity when first discovered appeared to have its chief interest in the domain of the physicist and the chemist. How vital a rôle it may yet prove to play as an active geologic agent, how wide a range of geologic processes it may yet be found to enter as a decisive

factor, has been brought out with a large measure of fulness in this new work by Joly. The first two chapters are chiefly an exposition of radioactivity from the historical, physical, and chemical standpoint. They lay the foundation for the geologic studies and the applications which follow. The third chapter gives data upon the occurrence and distribution of radium in the earth's surface materials and leads on to others in which some of the author's more notable inferences and speculations are set forth.

Radioactivity is made to appear as an agency of prime importance in the variations and fluctuations of underground temperature. A study based upon the rocks and underground temperatures of the St. Gotthard and Simplon tunnels is thought to show a distinct connection between the radioactivity and the temperature gradients in the earth. With less plausibility, the tendency of mountain ranges to develop along belts of thick sedimentation is assigned to the radioactivity of the buried sediments and the supposed consequent heating. Pushing the view still farther, the author even endeavors to explain the exigeant phases of the mountain structure of the Alps, such as the peculiar overlapping pile of recumbent folds as set forth by Lugeon, Schmidt, and others, by localized radioactive heating of the strata during the process of folding, and by a resulting upward shifting of the geotherms which is thought to enable the folded sediments above to be carried northward by the thrusts while the synclinal troughs beneath are becoming anchored in the growing viscosity of the medium. The idea is suggestive, but it lays a heavy tax on the new agency.

The chapter on "Radioactivity and the Interior of the Earth" and the one following set forth the possibilities of radioactivity as a more profound source of the thermal energy of the globe; however, the author believes that the radium of the earth is largely concentrated in the outer 12 to 15 kilometers of the crust.

Strutt has estimated the age of various sedimentary beds by determining the amount of helium which they contain and comparing this with the rapidity with which this gas is developed from the radioactive materials present. He reaches the conclusion that the Carboniferous must date back above 140,000,000 years, as a minor limit, and the Huronian probably 400,000,000 years. Though a most enthusiastic supporter of the great importance of radioactivity as a geologic agent and as a clue to the unraveling of geologic history, Joly is inclined to place greater reliance upon estimates of the age of the earth based upon denudation, and upon the saltness of the sea, than upon those based upon the radium and helium content of the sedimentary deposits.

The book bristles with new suggestions, and as such is a contribution of stimulating value. Necessarily, however, many of the conclusions thus put forth somewhat tentatively must be received with reserve.

R. T. C.

The Whitehorse Copper Belt, Yukon Territory. By R. G. McCONNELL. Canada Department of Mines, Geological Survey Branch, 1909.

These very interesting copper deposits are located in the southern part of the Yukon territory, extending along the valley of the Lewes River for a distance of about twelve miles. The rocks of the district are limestones probably belonging to the Carboniferous period, cut by three sets of intrusions of Mesozoic age. Of these the second set, consisting of granites and granodiorites, are economically important. Overlying these rocks are basalt flows belonging to the Tertiary, and glacial silts and bowlder clays.

The ore deposits are all contact metamorphic in origin, chiefly in the limestone along its contact with the granite. Two types of deposits are noted, the magnetite ore bodies and the siliceous ore bodies. In the former, the chief minerals are magnetite, bornite, chalcopyrite, serpentine, calcite, clinochore, rarely pyrrhotite and sphalerite. In the latter, associated with the ore minerals, bornite and chalcopyrite, are andradite, augite, tremolite, actinolite, epidote, and calcite. The granite itself is mineralized for some distance from the contact, the same minerals being developed as in the limestone. The deposits are peculiar in having bornite as the principal ore mineral, and in having little or no secondary sulphide enrichment. The values in copper range from 3.20 per cent to 12.90 per cent, the richest being from the Valerie Mine, in which bornite is absent and chalcopyrite is the only known copper sulphide present.

E. R. L.

Eighteenth Annual Report of the Bureau of Mines, Ontario, 1909. Vol. XVIII, Part I.

The Report contains the following papers: "Statistical Review, by Thos. W. Gibson, Deputy Minister of Mines, pp. 5–78; "Mines of Ontario," by E. T. Corkill, Inspector, pp. 79–140; "Iron Ranges of Nipigon District," by A. P. Coleman, pp. 141–53; "Iron Range North of Round Lake," by E. S. Moore, pp. 154–62; "Black Sturgeon Iron Region," by A. P.